

CLAIMS

What is claimed is:

1. A cuttable illumination device, comprising:
 - a first lamp having an input and an output;
 - a second lamp having an input and an output, said second lamp input connected to said first lamp output, such that said lamps are connected in series;
 - a current source element having a substantially constant current characteristic, said current source element connected to said second lamp output, said first lamp having a voltage drop characteristic corresponding to said current characteristic of said current source element; and
 - a voltage breakdown element having an input and an output, said voltage breakdown element input connected to said first lamp input and said voltage breakdown element output connected to said first lamp output, said voltage breakdown element having a breakdown voltage characteristic that is greater than said first lamp voltage drop characteristic.
2. The cuttable illumination device of claim 1, wherein said first lamp is a first light-emitting diode (LED) and wherein said second lamp is a second LED.
3. The cuttable illumination device of claim 2, wherein said first LED has a maximum forward voltage characteristic, and wherein said voltage breakdown element is a Zener diode having a voltage breakdown characteristic that is greater than said first LED maximum forward voltage characteristic.

4. The cuttable illumination device of claim 3, wherein said current source element has:
 - a voltage regulator having an input, an output, and a ground connection, said voltage regulator input connected to said second LED output, said voltage regulator ground connection connected to ground, said voltage regulator having a substantially fixed output voltage characteristic, said voltage regulator having a ground current characteristic that is negligible, such that the voltage regulator output current substantially equals the voltage regulator input current; and
 - a load resistor having an input and an output, said load resistor input connected to said voltage regulator output, said load resistor output connected to ground, such that said substantially fixed output voltage characteristic across said load resistor will create said substantially constant current source current characteristic.
5. The cuttable illumination device of claim 4, further having an elongated circuit board element having a distal portion and a remaining portion, wherein said first LED is mounted to said circuit board distal portion, and said Zener diode and said second LED are mounted to said remaining portion, such that said circuit board distal portion may be cut from said circuit board remaining portion, thereby severing said first LED from said cuttable illumination device.
6. The cuttable illumination device of claim 5, further having a waveguide member having:
 - a rod-like shape;
 - a predetermined length;
 - a lateral light-receiving surface; and

a lateral light-emitting surface;
said waveguide member being composed of a material that has both optical waveguide
and light scattering properties;
the light-receiving surface of said waveguide member being positioned adjacent said first
LED and said second LED, such that light from said LEDs entering said
waveguide member is preferentially scattered causing a light intensity pattern that
appears substantially uniform along the light-emitting surface of said waveguide
member.

7. The cuttable illumination device of claim 6, further comprising a housing positioned
below and extending along said waveguide member, said housing enclosing said circuit board,
said first LED, said Zener diode and said second LED.

8. The cuttable illumination device of claim 7, wherein said housing has a pair of side walls
and a floor portion connecting said side walls, said side walls and said floor portion defining a
channel that extends substantially said predetermined length of said waveguide member, said
circuit board, said first LED, said Zener diode and said second LED received within said
channel.

9. The cuttable illumination device of claim 8, wherein said side walls and said floor portion
have internal surfaces that are reflective.

10. The cuttable illumination device of claim 7, wherein the position of said circuit board, said first LED, said Zener diode and said second LED within said housing are maintained by filling said channel with potting material.

11. The cuttable illumination device of claim 4, further having an additional LED / Zener diode section, said additional LED / Zener diode section having:

a third LED inserted between said second LED output and said voltage regulator input;

and

a second Zener diode having an input and an output, said second Zener diode input connected to said first Zener diode input, said second Zener diode output connected to said second LED output, said second Zener diode having a voltage breakdown characteristic greater than the sum of the maximum forward voltage drops of said first LED and said second LED.

12. The cuttable illumination device of claim 4, further having a number of additional LED / Zener diode sections, each successive LED / Zener diode section characterized by an incremental number, n, each successive LED / Zener diode section having:

an LED, D_{2+n} , inserted between the output of the LED, D_{1+n} , of the previous section and said voltage regulator input; and

a Zener diode, ZD_{1+n} , having an input and an output, each successive Zener diode, ZD_{1+n} , input connected to the input of the Zener diode, ZD_n , of the previous section, each successive Zener diode, ZD_{1+n} , output connected to said output of the LED, D_{1+n} , of the previous section , each successive Zener diode, ZD_{1+n} , having a voltage

breakdown characteristic greater than the sum of the maximum forward voltage drops of the LEDs, D₁ through D_{1+n}, of the cuttable illumination device.

13. A method of shortening the length of an illumination device without adversely effecting the function and performance of the remaining portion of the illumination device, said method of shortening comprising:

providing a cuttable illumination device having:

a first lamp having an input and an output;

a second lamp having an input and an output, said second lamp input connected to said first lamp output, such that said lamps are connected in series;

a current source element having a substantially constant current characteristic, said current source element connected to said second lamp output, said first lamp having a voltage drop characteristic corresponding to said current characteristic of said current source element;

a voltage breakdown element having an input and an output, said voltage breakdown element input connected to said first lamp input and said voltage breakdown element output connected to said first lamp output, said voltage breakdown element having a breakdown voltage characteristic that is greater than said first lamp voltage drop characteristic; and

an elongated circuit board element having a distal portion and a remaining portion, wherein said first lamp is mounted to said circuit board distal portion, and wherein said second lamp, said current source element, and

said voltage breakdown element are mounted to said circuit board
 remaining portion; and

 cutting said circuit board distal portion from said circuit board remaining portion, thereby
 severing said first lamp from said cuttable illumination device and shortening the
 length of said circuit board without adversely effecting the function and
 performance of the remaining portion of the illumination device.

14. The method of shortening the length of an illumination device of claim 13, wherein said
first lamp and said second lamp are light-emitting diodes (LEDs), wherein said voltage
breakdown element is a Zener diode, and wherein said current source element has a voltage
regulator and a load resistor, said load resistor connected between the output of the voltage
regulator and ground.

15. The method of shortening the length of an illumination device of claim 14, wherein said
cuttable illumination device further has:

 a waveguide member having a rod-like shape, a predetermined length, a lateral light-
 receiving surface, and a lateral light-emitting surface, said waveguide member
 being comprised of a material that has both optical waveguide and light scattering
 properties, the light-receiving surface of said waveguide member being positioned
 adjacent said LEDs;

 a housing positioned below and extending along said waveguide member, said housing
 enclosing said circuit board, said LEDs, said Zener diode, said voltage regulator
 and said load resistor, said housing having a pair of side walls and a floor portion

connecting said side walls, said side walls and floor portion having reflective internal surfaces; and
potting material between said circuit board and said housing.

16. A cuttable illumination device, comprising:
 - a first lamp having an input and an output;
 - a second lamp having an input and an output, said second lamp input connected to said first lamp output, such that said lamps are connected in series;
 - a means for generating a substantially constant current through said first lamp and said second lamp;
 - a means for conducting current at a predetermined voltage threshold that is greater than the voltage across said first lamp, said means for conducting current being connected across said first lamp; and
 - a power supply for supplying power to said first lamp, said second lamp, said means for generating a substantially constant current, and said means for conducting current at a predetermined voltage threshold.

17. The cuttable illumination device of claim 16, wherein said means for generating a substantially constant current has:

a voltage regulator having an input, an output, and a ground connection, said voltage regulator input connected to said second lamp output, said voltage regulator ground connection connected to ground, said voltage regulator having a substantially fixed output voltage characteristic, said voltage regulator having a

ground current characteristic that is negligible, such that the voltage regulator output current substantially equals the voltage regulator input current; and a load resistor having an input and an output, said load resistor input connected to said voltage regulator output, said load resistor output connected to ground, such that said substantially fixed output voltage characteristic across said load resistor will generate said substantially constant current.

18. The cuttable illumination device of claim 17, wherein said means for conducting current at a predetermined voltage threshold is a Zener diode.

19. The cuttable illumination device of claim 18, wherein said first lamp is a first light-emitting diode (LED) and wherein said second lamp is a second LED.

20. The cuttable illumination device of claim 19, further having an elongated circuit board element having a distal portion and a remaining portion, wherein said first LED is mounted to said circuit board distal portion and said Zener diode and said second LED are mounted to said remaining portion, such that said circuit board distal portion may be cut from said circuit board remaining portion thereby severing said first LED from said cuttable illumination device.

21. The cuttable illumination device of claim 20 further having a waveguide member having:
a rod-like shape;
a predetermined length;
a lateral light-receiving surface; and

a lateral light-emitting surface;
said waveguide member being comprised of a material that has both optical waveguide
and light scattering properties;
the light-receiving surface of said waveguide member being positioned adjacent said first
LED and said second LED, such that light from said LEDs entering said
waveguide member is preferentially scattered causing a light intensity pattern that
appears substantially uniform along said the light-emitting surface of said
waveguide member.

22. The cuttable illumination device of claim 21, further comprising a housing positioned
below and extending along said waveguide member, said housing enclosing said circuit board,
said first LED, said Zener diode and said second LED.

23. The cuttable illumination device of claim 22, wherein said housing has a pair of side
walls and a floor portion connecting said side walls, said side walls and said floor portion
defining a channel that extends substantially said predetermined length of said waveguide
member, said circuit board, said first LED, said Zener diode and said second LED received
within said channel.

24. The cuttable illumination device of claim 23, wherein said side walls and said floor
portion have internal surfaces that are reflective.

25. The cuttable illumination device of claim 23, further having potting material filling said channel, wherein the position of said circuit board, said first LED, said Zener diode and said second LED within said housing are maintained by said potting material.

26. The cuttable illumination device of claim 19, further having an additional LED / Zener diode section, said additional LED / Zener diode section having:

a third LED inserted between said second LED output and said voltage regulator input;

and

a second Zener diode having an input and an output, said second Zener diode input connected to said first Zener diode input, said second Zener diode output connected to said second LED output, said second Zener diode having a voltage breakdown characteristic greater than the sum of the maximum forward voltage drops of said first LED and said second LED.

27. The cuttable illumination device of claim 19, further having a number of additional LED / Zener diode sections, each successive LED / Zener diode section characterized by an incremental number, n, each successive LED / Zener diode section having:

an LED, D_{2+n} , inserted between the output of the LED, D_{1+n} , of the previous section and said voltage regulator input; and

a Zener diode, ZD_{1+n} , having an input and an output, each successive Zener diode, ZD_{1+n} , input connected to the input of the Zener diode, ZD_n , of the previous section, each successive Zener diode, ZD_{1+n} , output connected to said output of the LED, D_{1+n} , of the previous section , each successive Zener diode, ZD_{1+n} , having a voltage

breakdown characteristic greater than the sum of the maximum forward voltage drops of the LEDs, D_1 through D_{1+n} , of the cuttable illumination device.